

Upgrading MX240, MX480, and MX960 3D Universal Edge Router Fan Trays and Power Supplies

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This document describes the necessary steps to be taken to upgrade any Juniper Networks MX Series 3D Universal Edge Router chassis to higher capacity cooling and higher capacity power. Step-by-step descriptions are given for replacement of the various parts in the chassis. All of these upgrades can be performed while the system is operational, but it is important to follow the complete process through.

In this guide, three areas are addressed, and all three have to be completed before your MX Series router is fully enabled for higher capacity power and cooling.

- Cooling
- Power
- Rating label change

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MX Router High-Capacity Power Supply Upgrade Requirements

In order to upgrade the MX router to high-capacity power supplies, there are several prerequisites before you can perform the upgrade.

- Rating label upgrade

The rating label upgrade ensures that the chassis rating is in line with the optional higher capacity power supplies that may be installed in your MX Series router.

- Junos OS version

Before upgrading, the MX Series router must be running the Junos OS release listed in [Table 1 on page 3](#). Note that there are minimum software revision requirements for the cooling and power supplies. Without this minimum software revision, these new parts are not supported and likely not detected and managed properly.

Table 1: Minimum Required Junos OS Release

Component	Minimum Required Junos OS Release
MX240 and MX480 high-capacity fan trays	10.0 R1
MX960 high-capacity fan trays	
MX240 AC high-capacity power supplies	10.0 R2
MX240 DC high-capacity power supplies	
MX480 AC high-capacity power supplies	
MX480 DC high-capacity power supplies	
MX960 AC high-capacity power supplies	
MX960 DC high-capacity power supplies	10.2 R1

- Additional power feeds required for MX960 DC and MX960 AC power supplies

Additional power feeds are required before you begin the upgrade process for MX960. MX960 high-capacity DC and AC power supplies require two feeds per power supply to operate at full power. Fully redundant power supply configuration requires eight feeds, up from four feeds. The power supplies also operate in a one feed mode which provide lower output power. In this mode, no additional feeds are required. The number of power feeds for MX240 and MX480 high-capacity power supplies is unchanged.

- High-capacity fan trays (MX240 and MX480) and high-capacity air filter tray (MX960)

The MX Series high-capacity fan trays satisfy cooling requirements of MPCs, and must be upgraded for proper cooling. Additionally, for the MX960 router, you must upgrade both fan trays and the filter tray.

- Additional clearance to accommodate the depth of the MX960 high-capacity power supplies

Additional clearance is required to accommodate the depth of the MX960 high-capacity power supplies; they extend beyond the chassis as shown in [Table 2 on page 4](#). [Figure 1 on page 4](#) and [Figure 2 on page 5](#) shows the chassis dimensions with both the standard and extended cable managers installed.

Table 2: Clearance Requirements for High-Capacity Power Supplies

Power Supply	Additional depth requirement
MX960 high-capacity AC power supply	2.85 in. (7.24 cm)
MX960 high-capacity DC power supply	5.05 in. (12.83 cm)

Figure 1: Chassis Dimensions and Clearance Requirements for the MX960 Router with High-Capacity DC Power Supplies

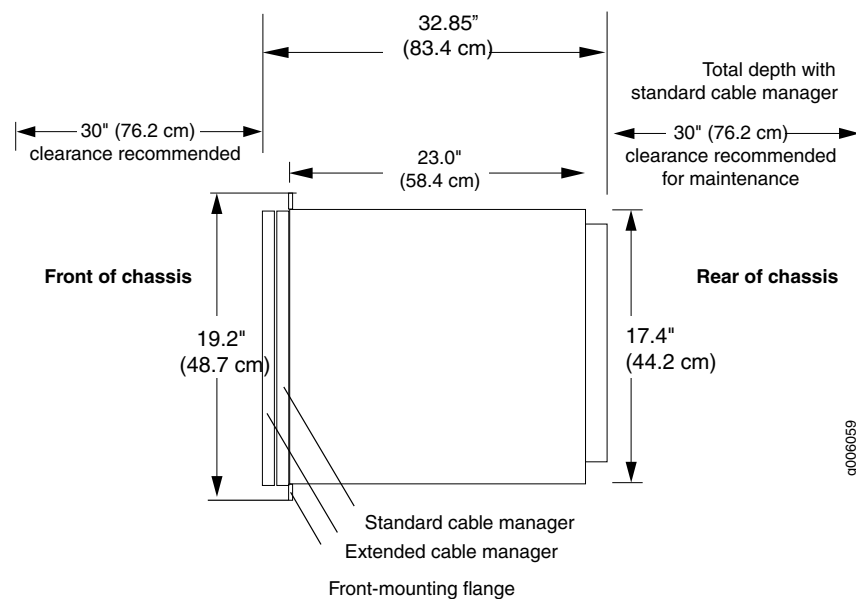
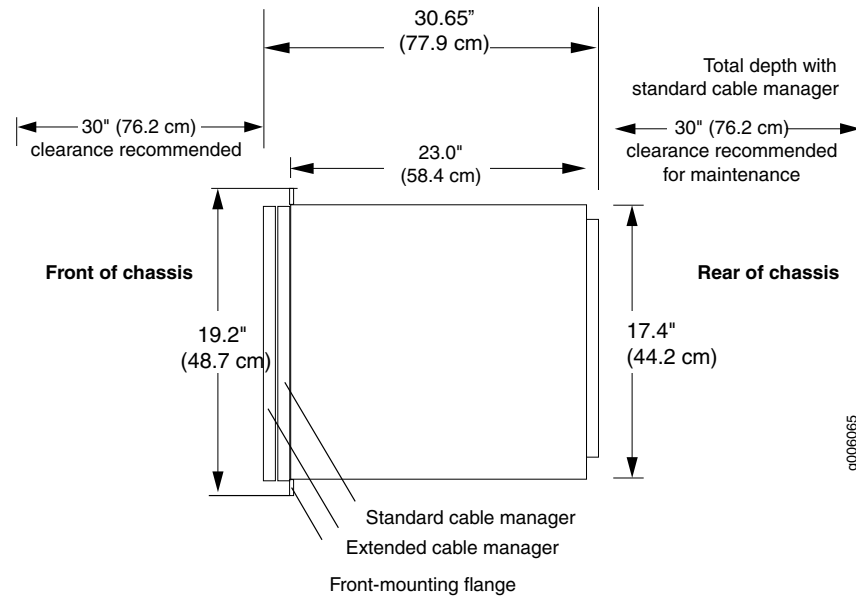


Figure 2: Chassis Dimensions and Clearance Requirements for the MX960 Router with High-Capacity AC Power Supplies



NOTE: Combinations of normal-capacity and high-capacity power supplies and fan trays are not supported outside of the upgrade window.



CAUTION: The router cannot be powered from AC and DC power supplies simultaneously. The first type of power supply detected by the router when initially powered on determines the type of power supply allowed by the router. All installed power supplies of the other type are disabled by the router. If you install a power supply of the other type while the router is operating, the router disables the power supply and generates an alarm.

Rating Label Upgrade Procedure

To attach the agency label:

1. Locate the agency label on the chassis. The labels are located on the side of the chassis as illustrated in [Figure 3 on page 6](#), [Figure 4 on page 6](#), and [Figure 5 on page 7](#).
2. Remove the protective backing from the new label and apply it over the current label on the chassis.

Figure 3: MX240 Rating Label

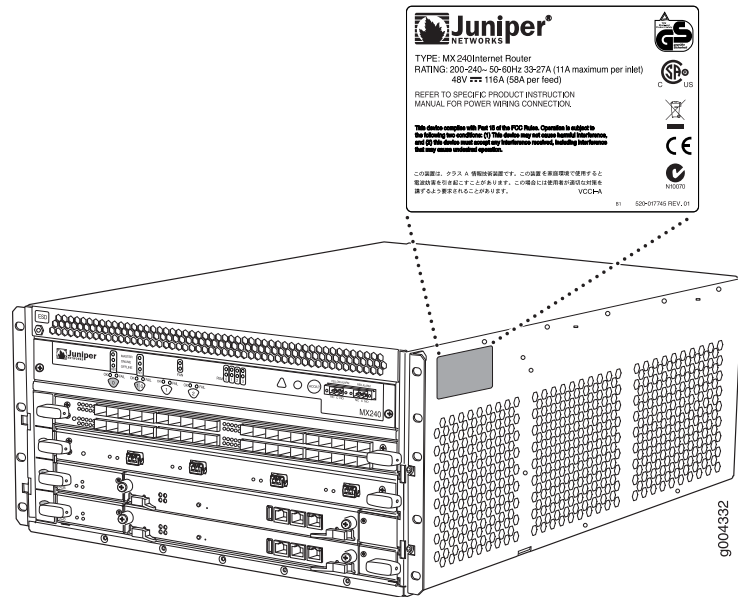


Figure 4: MX480 Rating Label

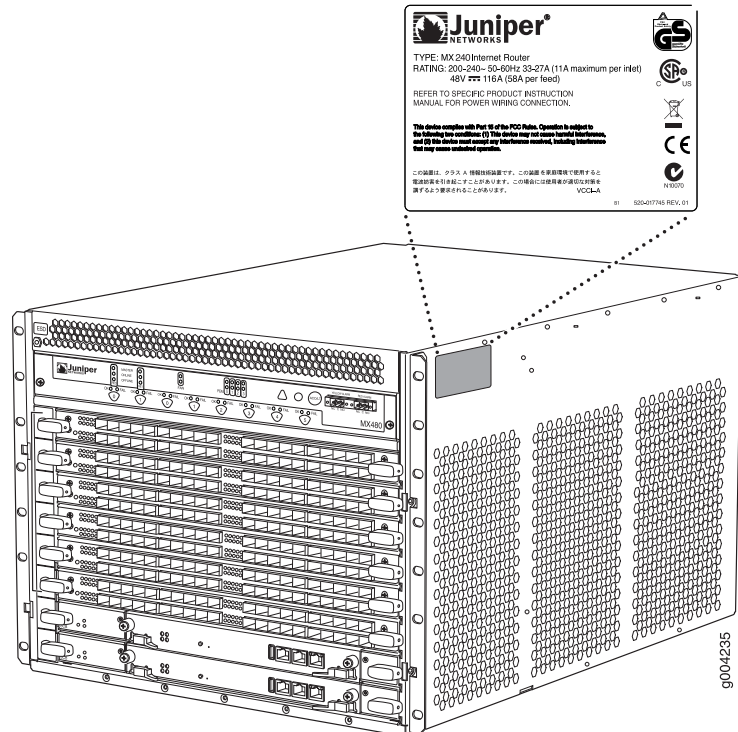
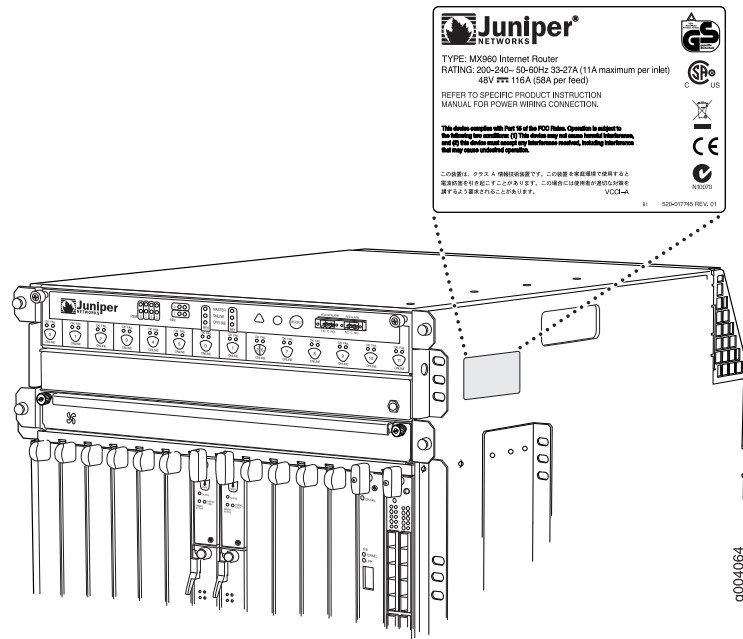


Figure 5: MX960 Rating Label



Fan Tray Upgrade Overview

To upgrade the fan trays, use the procedures in the following sections.



NOTE: Before upgrading the fan tray, make sure the MX Series router is running Junos OS Release 10.0 R1 or later to support high-capacity fan trays.



NOTE: To prevent overheating, install the replacement fan tray within two minutes of removing the normal-capacity fan tray.

Figure 6: MX960 High-Capacity Fan Tray

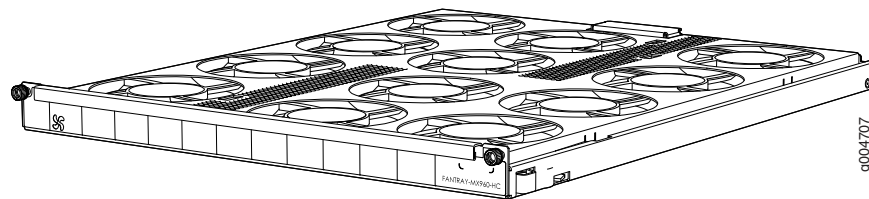


Figure 7: MX480 High-Capacity Fan Tray

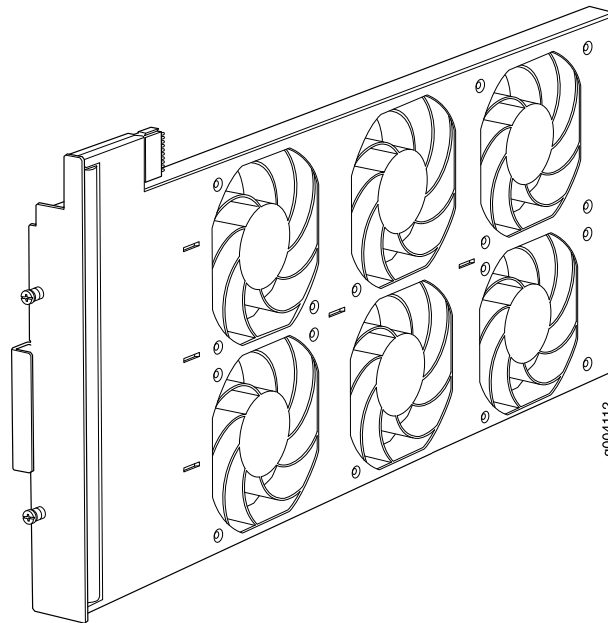
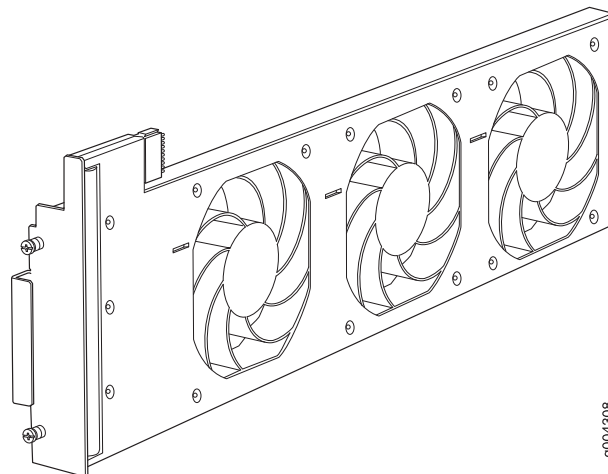


Figure 8: MX240 High-Capacity Fan Tray



Installing the MX240 High-Capacity Fan Tray

To remove the fan tray (see [Figure 9 on page 9](#)):

1. Loosen the captive screws on the fan tray faceplate.
2. Grasp the fan tray handle and pull it out approximately 1 to 3 inches.



NOTE: The illustration below shows the direction of the fan tray for removal. Pull the fan tray out 1 to 3 inches initially, grasp it, then remove it completely from the chassis.

3. Press the latch located on the inside of the fan tray to release it from the chassis.
4. Place one hand under the fan tray to support it and pull the fan tray completely out of the chassis as shown in [Figure 9 on page 9](#).

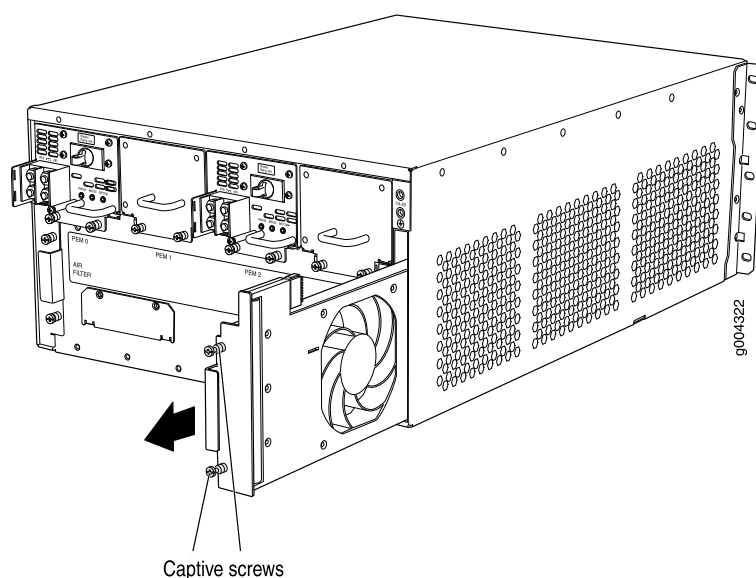


WARNING: To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.



NOTE: To prevent overheating, install the replacement fan tray within two minutes of removing the normal-capacity fan tray.

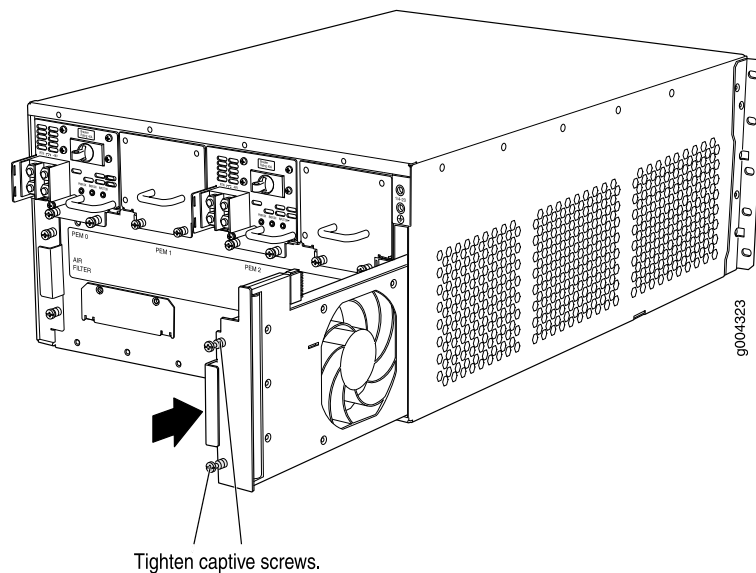
Figure 9: Removing the Fan Tray



To install the fan tray (see [Figure 10 on page 10](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray on each side and insert it straight into the chassis. Note the correct orientation by the "this side up" label on the top surface of the fan tray.
3. Tighten the captive screws on the fan tray faceplate to secure it in the chassis.

Figure 10: Reinstalling a Fan Tray



Installing the MX480 High-Capacity Fan Tray

To remove the fan tray (see [Figure 11 on page 11](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to an approved site ESD grounding point. See the instructions for your site.
2. Loosen the captive screws on the fan tray faceplate.
3. Grasp the fan tray handle and pull it out approximately 1 to 3 inches.



NOTE: [Figure 11 on page 11](#) shows the direction of the fan tray for removal. Pull the fan tray out 1 to 3 inches initially, grasp it, then remove it completely from the chassis.

4. Press the latch located on the inside of the fan tray to release it from the chassis.
5. Place one hand under the fan tray to support it and pull the fan tray completely out of the chassis as shown in [Figure 11 on page 11](#).

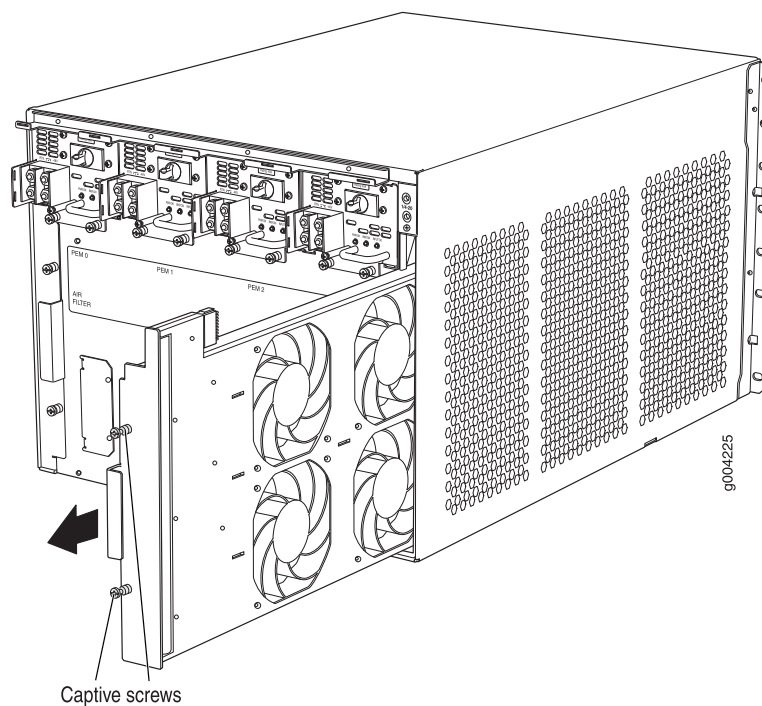


WARNING: To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.



NOTE: To prevent overheating, install the replacement fan tray within two minutes of removing the normal-capacity fan tray.

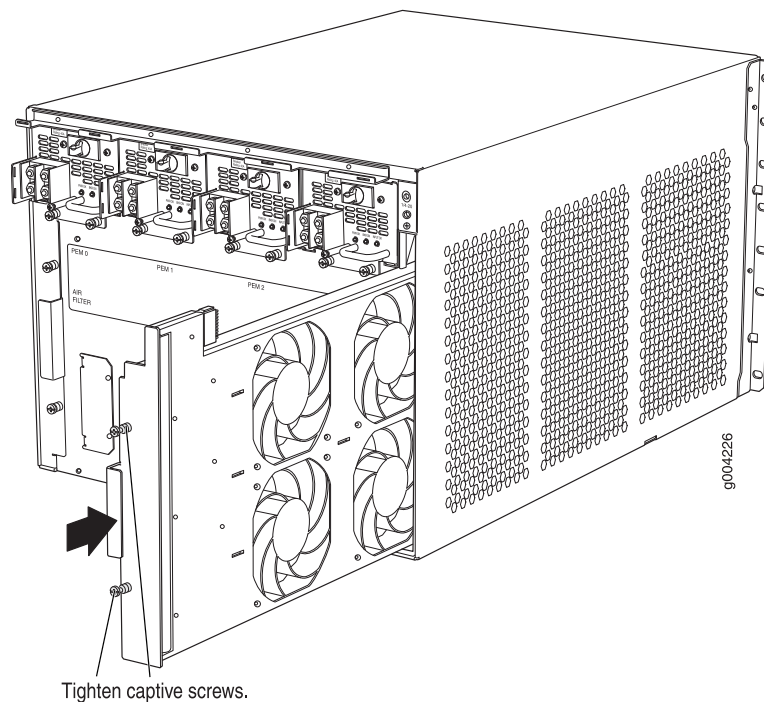
Figure 11: Removing the Fan Tray



To install the fan tray (see [Figure 12 on page 12](#)):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray on each side, and insert it straight into the chassis. Note the correct orientation by the "this side up" label on the top surface of the fan tray.
3. Tighten the captive screws on the fan tray faceplate to secure it in the chassis.

Figure 12: Reinstalling a Fan Tray



Upgrading the MX960 High-Capacity Upper Fan Tray

It is required that you upgrade both MX960 fan trays as well as the fan filter tray. To remove the normal-capacity fan tray and install the MX960 high-capacity upper fan tray, use the following procedures.



NOTE:

To prevent overheating:

- One fan tray should always be installed and operational during the upgrade process.
- Install the replacement fan tray within two minutes of removing the normal-capacity fan tray.

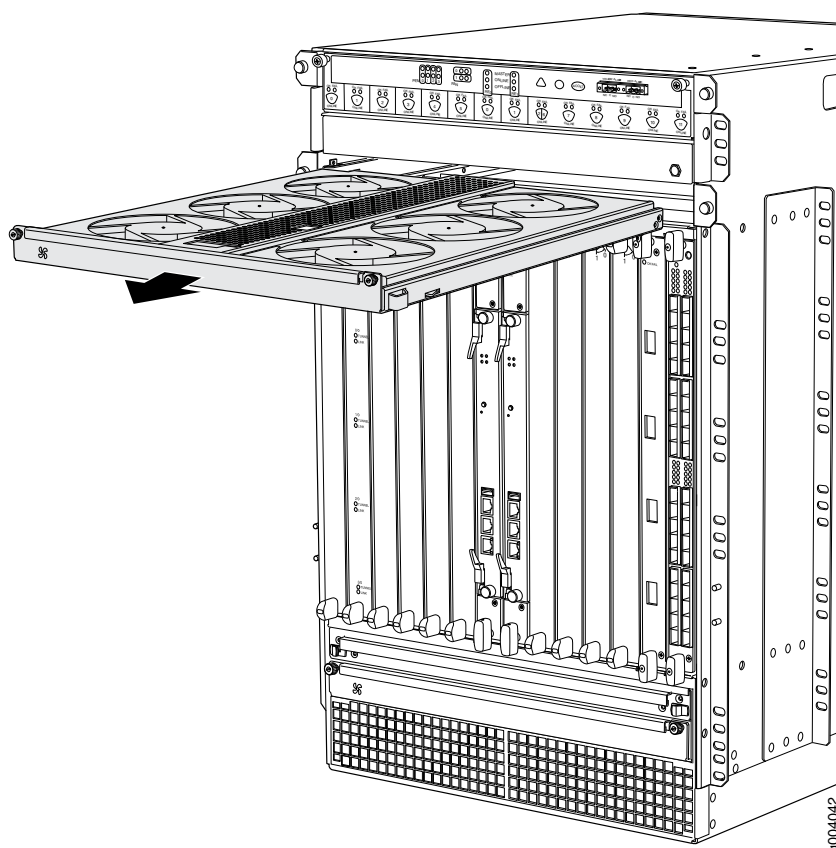
To remove the upper normal-capacity fan tray:

1. Remove the upper acoustic noise cover if it is installed. Rotate the latch knobs counterclockwise until the cover is released or until the knobs stop turning.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Loosen the captive screw on each side of the fan tray faceplate.



NOTE: Figure 13 on page 13 shows the direction of the fan tray for removal. Pull the fan tray out 1 to 3 inches initially, grasp it, then remove it completely from the chassis.

Figure 13: Removing a Normal-Capacity Upper Fan Tray



4. Press on the two latches located on the inside of the fan tray to release the fan tray from the chassis.
5. Place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis as shown in Figure 13 on page 13.



WARNING: To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.

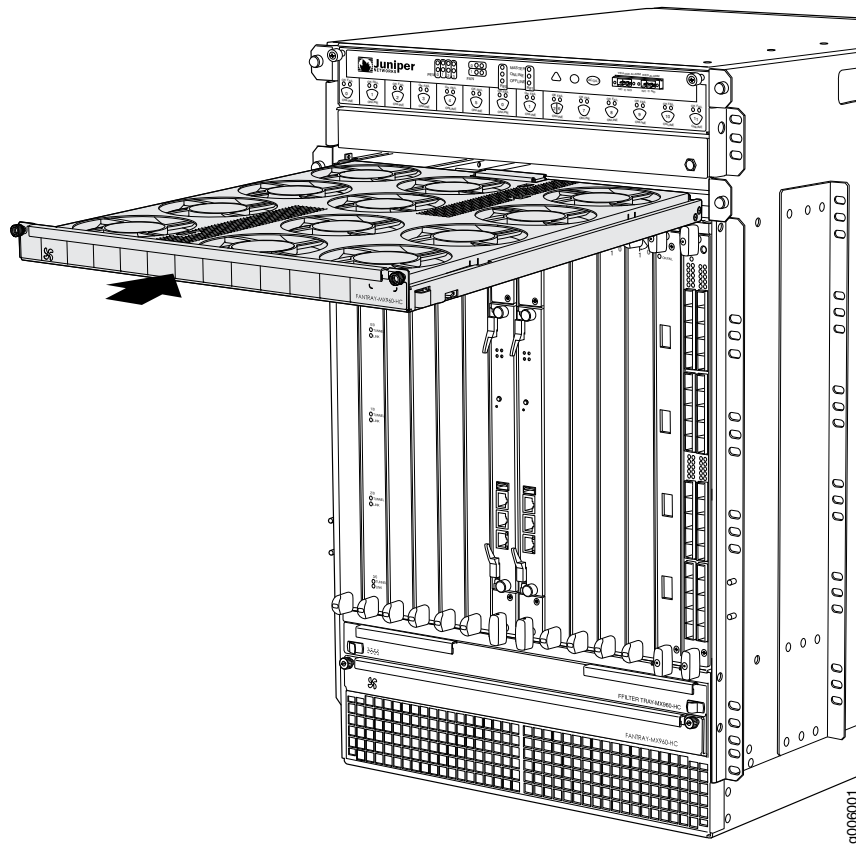
To install the upper high-capacity fan tray, use the following procedure. If the acoustic noise cover is installed, the upper acoustic cover must be removed.



NOTE: Verify that you are installing the high-capacity fan tray; the tray is labeled "FFAN Tray HC MX960."

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray on each side, and insert it straight into the chassis as shown in [Figure 14 on page 14](#).
3. Tighten the captive screws on each side of the fan tray faceplate to secure it in the chassis.

Figure 14: Installing an Upper High-Capacity Fan Tray



Reinstall the acoustic noise cover using the following procedure.

1. Before placing the cover onto the router, rotate the latch knobs counterclockwise until they stop turning. This will ensure that the latch is open enough to hook behind the lip.
2. Place the cover over the upper fan tray.
3. Secure the lip of the cover in the groove directly below the craft interface.
4. Rotate the latch pins clockwise, and tighten them until the rotation stops.

Installing the MX960 High-Capacity Lower Fan Tray

It is required to upgrade both MX960 fan trays, as well as the fan filter tray. Prior to replacing the lower MX960 fan tray, you must lift up the standard cable manager if it is installed. To install the MX960 high-capacity lower fan tray, use the following procedures.



NOTE: To prevent overheating, one fan tray should always be installed and operational during the upgrade process.



NOTE: To prevent overheating, install the replacement fan tray within two minutes of removing the normal-capacity fan tray.

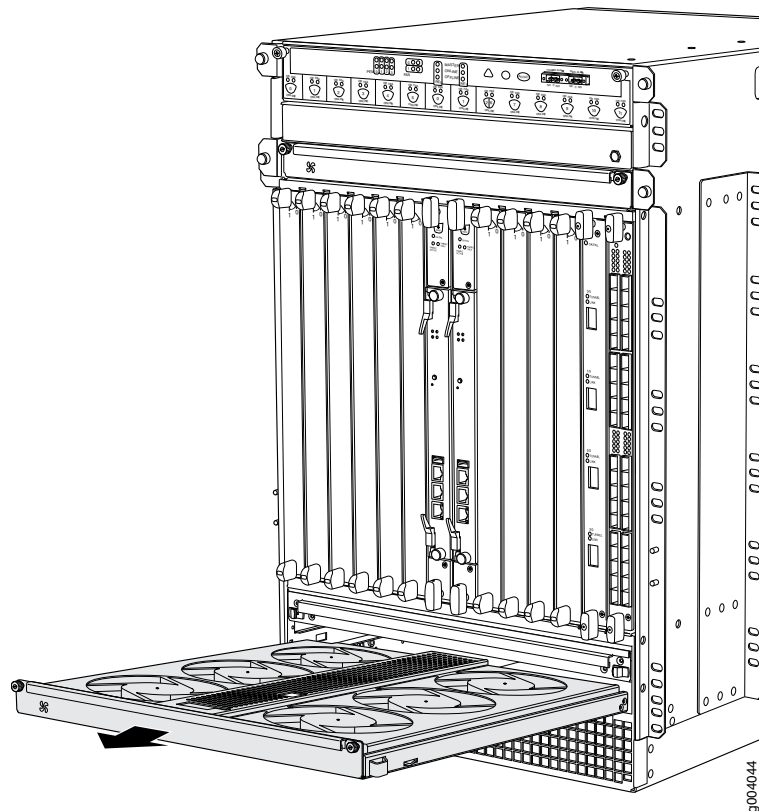
To remove the normal-capacity lower fan tray:

1. If the standard cable manager is installed, simultaneously pull the two releases labeled **PULL** on the standard cable manager. Lift it up and outward to lock it in place.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Loosen the captive screw on each side of the fan tray faceplate.
4. Grasp both sides of the fan tray and pull it out approximately 1 to 3 inches.



NOTE: Figure 15 on page 16 shows the direction of the fan tray for removal. Pull the fan tray out 1 to 3 inches initially, grasp it, then remove it completely from the chassis.

Figure 15: Removing an MX960 Normal-Capacity Lower Fan Tray



5. Press on the two latches located on the inside of the fan tray to release the fan tray from the chassis.
6. Place one hand under the fan tray to support it, and pull the fan tray completely out of the chassis as shown in [Figure 15 on page 16](#).



WARNING: To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.



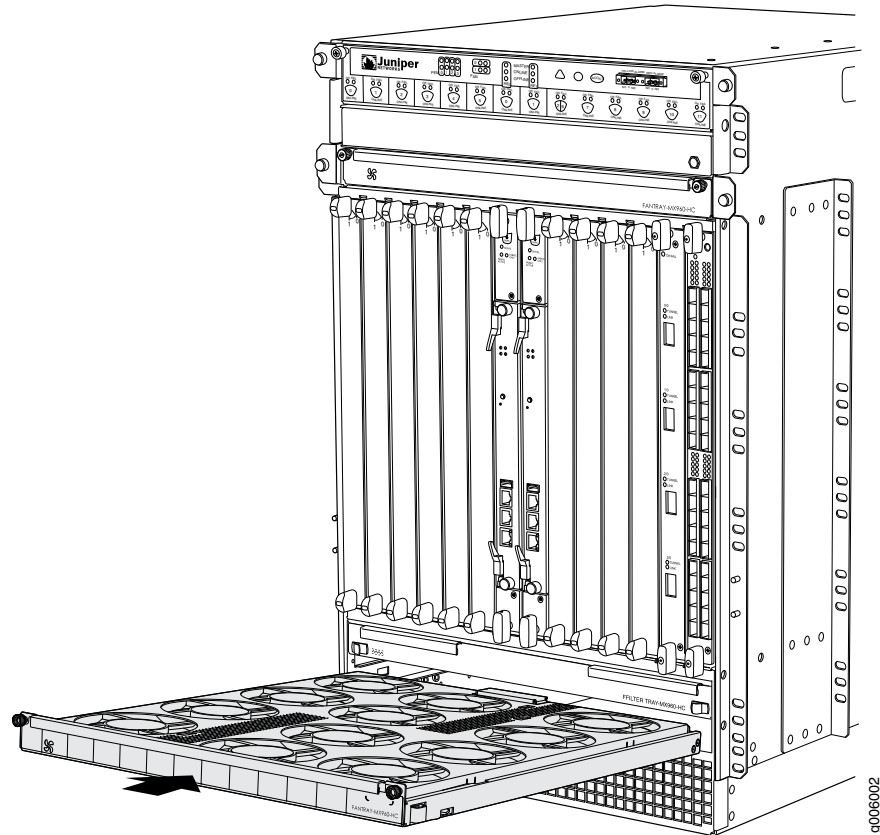
NOTE: Verify that you are installing the high-capacity fan tray; the tray is labeled “FFAN Tray HC MX960.”

To install the lower high-capacity fan tray, use the following procedure:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Grasp the fan tray on each side, and insert it straight into the chassis as shown in [Figure 16 on page 17](#).

3. Tighten the captive screws on each side of the fan tray faceplate to secure it in the chassis.

Figure 16: Installing an MX960 High-Capacity Lower Fan Tray



Upgrading the MX960 Air Filter Tray

For proper cooling, it is necessary to upgrade the fan filter tray in addition to both fan trays.



NOTE: Mixing of high-capacity fan trays and the normal-capacity fan filter tray is not supported.

Removing the Normal-Capacity MX960 Air Filter

To remove the normal-capacity air filter tray, use the following procedure.

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.



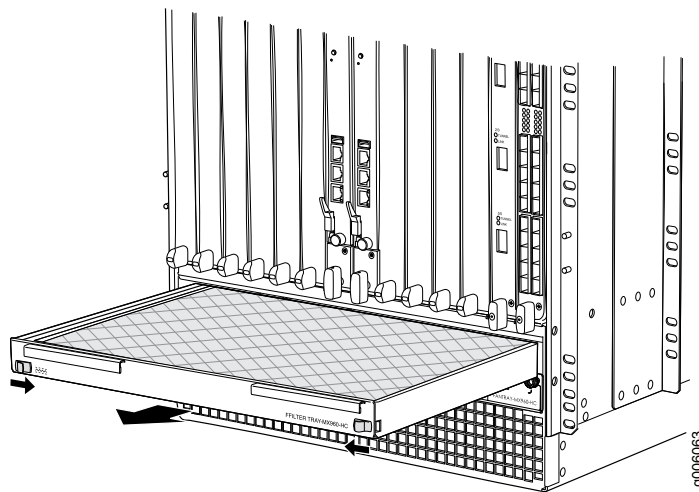
CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.



CAUTION: Do not run the router for more than two minutes without the air filter in place.

2. Pull the filter tray release on both sides of the filter tray.
3. Slide the air filter tray out of the chassis as shown in [Figure 17 on page 18](#).

Figure 17: Removing the Normal-Capacity Air Filter Tray from the Chassis



Installing the MX960 High-Capacity Tray and Filter

To install the high-capacity air filter, use the following procedure.

1. Verify that the air flow arrow is pointing upwards.



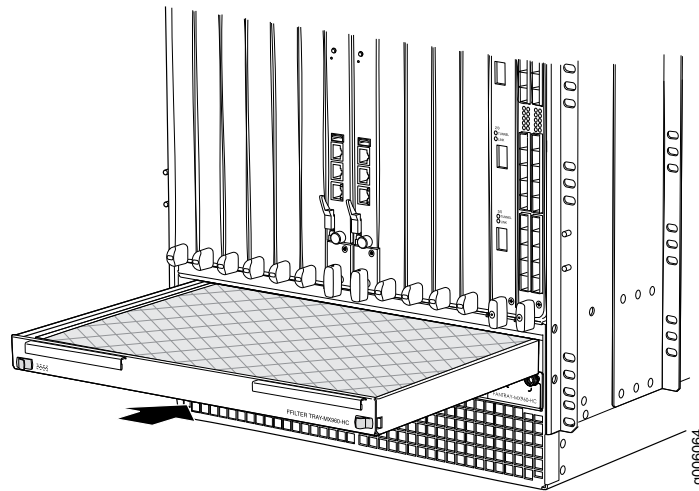
NOTE: The filter tray is shipped with the filter in the tray.



NOTE: Verify that you are installing the high-capacity air filter and tray, it is labelled "Filter Tray-MX960-HC."

2. Insert the air filter tray into the chassis by sliding it straight into the chassis until it stops as shown in [Figure 18 on page 19](#).

Figure 18: Inserting the High-Capacity Air Filter Tray into the Chassis



3. Lower the cable manager back into position.
4. Rearrange the cables in the cable manager.

Power Supply Upgrade Overview

A minimum number of power supplies must be present in the router at all times during the upgrade procedure. [Table 3 on page 19](#) lists the minimum number of power supplies that must be present in the router. The minimum configuration is unchanged with the exception of MX960 high-capacity AC power supply which decreases from 3 to 2 per system.

Upgrading MX-Series power supplies comprises upgrading each power supply in a prescribed order. Upgrading an individual power supply comprises removing the normal-capacity power supply in the slot and installing a high-capacity power supply in that slot. The removal and installation steps are then repeated for each subsequent slot in a prescribed order. [Table 4 on page 20](#) outlines the upgrade sequence. If a normal capacity power supply is not present in that slot, skip that slot.

Table 3: Minimum Required Number of Power Supplies

Router Model	Configuration	Minimum Required Number of Power Supplies	
		Normal-Capacity	High-Capacity
MX240	AC – high line	1	1
MX240	AC – low line	2	2
MX240	DC	1	1
MX480	AC – high line	2	2
MX480	AC – low line	3	3

Table 3: Minimum Required Number of Power Supplies (*continued*)

Router Model	Configuration	Minimum Required Number of Power Supplies	
		Normal-Capacity	High-Capacity
MX480	DC	2	2
MX960	AC	3	2
MX960	DC	2	2

Table 4: Normal-Capacity to High-Capacity Upgrade Sequence for MX240, MX480, and MX960

Upgrade power supply in slot 0 if present. If empty, skip to next slot.

Upgrade power supply in slot 1 if present. If empty, skip to next slot.

Upgrade power supply in slot 2 if present. If empty, skip to next slot.

Upgrade power supply in slot 3 if present.

Upgrade complete.

The procedures in the following sections go over the steps to upgrade a single power supply.

Upgrading the MX240 and MX480 AC Power Supplies

To upgrade the MX240 and MX480 AC power supplies, use the procedures in the following sections.



NOTE: During the upgrade process, the MX Series router can simultaneously run normal-capacity and high-capacity power supplies. However, it is recommended to upgrade all power supplies to high-capacity power supplies.

Removing the MX240 and MX480 Normal-Capacity AC Power Supplies



NOTE: The minimum number of power supplies must be present in the router at all times.



CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.



NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove a normal-capacity AC power supply:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the AC input switch next to the appliance inlet on the power supply to the off (O) position.
3. Remove the power cord from the AC power source.
4. Verify that the ON LED is not lit.
5. Remove the power cord from the power supply.
6. Unscrew the captive screws on the bottom edge of the power supply.
7. Pull the power supply straight out of the chassis.
8. Go to the next section on installing a high-capacity power supply in this slot.

Installing the MX240 and MX480 AC High-Capacity Power Supplies



NOTE: During the upgrade process, you can simultaneously run normal-capacity and high-capacity power supplies. However, it is recommended to upgrade all power supplies to high-capacity power supplies.

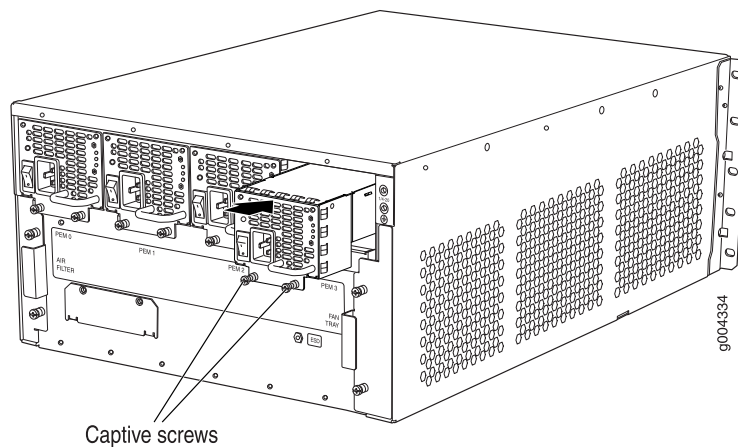
To install a high-capacity AC power supply:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
2. Move the AC input switch next to the appliance inlet on the power supply to the off (O) position.
3. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot as shown in [Figure 19 on page 22](#). The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
4. Tighten both captive screws at the bottom of the power supply.
5. Attach the power cord to the power supply.
6. Attach the power cord to the AC power source, and switch on the dedicated customer site circuit breaker. Follow the instructions for your site.
7. Move the AC input switch next to the appliance inlet on the power supply to the on (I) position and observe the status LEDs on the power supply faceplate. If the power

supply is correctly installed and functioning normally, the **AC OK** and **DC OK** LEDs light steadily and the **PS FAIL** LED is not lit.

8. Refer to [Table 5 on page 32](#) for the next slot to upgrade. If this is the last slot, the upgrade procedure is complete.

Figure 19: Installing an AC Power Supply



Upgrading the MX240 and MX480 DC Power Supplies

To upgrade the MX240 and MX480 DC power supplies, use the procedures in the following sections.

Removing the MX240 and MX480 Normal-Capacity DC Power Supplies



NOTE: The minimum number of power supplies must be present in the router at all times. [Table 3 on page 19](#) lists the required minimum number of power supplies.



WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.



CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

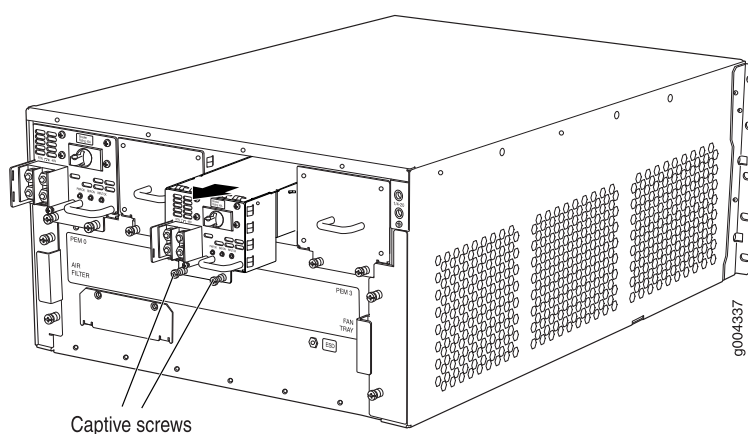


NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove a DC power supply (see [Figure 20 on page 23](#)):

1. Switch off the dedicated customer site circuit breaker for the power supply being removed. Follow your site's procedures for ESD.
2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
3. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
4. Move the power switch on the DC power supply faceplate to the off (O) position.
5. Remove the clear plastic cover protecting the terminal studs on the faceplate.
6. Remove the nut and washer from each of the terminal studs. (Use a 7/16-in. [11-mm] nut driver or socket wrench.)
7. Remove the cable lugs from the terminal studs.
8. Loosen the captive screws on the bottom edge of the power supply faceplate.
9. Carefully move the power cables out of the way.
10. Pull the power supply straight out of the chassis.
11. Go to the next section on installing a high-capacity power supply in this slot.

Figure 20: Removing a DC Power Supply from the Router



Installing the MX240 and MX480 DC High-Capacity Power Supplies



NOTE: During the upgrade process, you can simultaneously run normal-capacity and high-capacity power supplies. However, it is recommended to upgrade all power supplies to high-capacity power supplies.

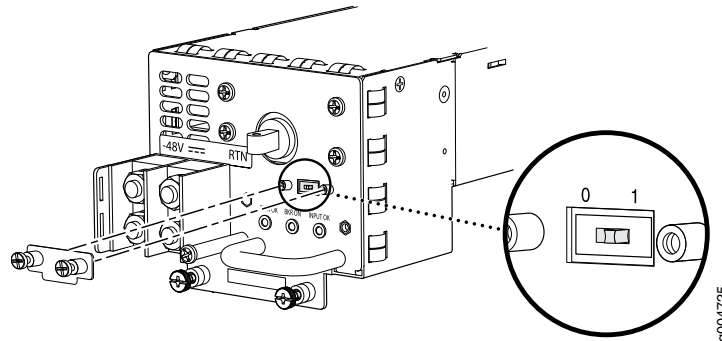


WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

To install a DC power supply (see [Figure 22 on page 27](#)):

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.
3. Move the power switch on the power supply faceplate to the off (O) position.
4. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate should be flush with any adjacent power supply faceplate or blank installed in the power supply slot.
5. Using a screwdriver, loosen the captive screw holding the metal cover over the input mode switch. Rotate the metal cover away from the input mode switch to expose the switch.
6. Check the setting of the input mode switch. Use a sharp, nonconductive object to slide the switch to the desired position. Set the input mode switch to position 0 for 60-A input and position 1 for 70-A input. This setting is used by the power management software and needs to be set before on the power supply. See [Changing the MX240 and MX480 DC High-Capacity Power Supply Input Mode Switch on page 43](#).

Figure 21: MX240 DC and MX480 DC High-Capacity Power Supply Input Mode Switch



7. Rotate the metal cover over the input mode switch, and use a screwdriver to tighten the captive screw.
8. Tighten the captive screws on the lower edge of the power supply faceplate.
9. Remove the clear plastic cover protecting the terminal studs on the faceplate.
10. Remove the nut and washer from each of the terminal studs.
11. Secure each power cable lug to the terminal studs, first with the flat washer, then with the split washer, and then with the nut (see [Figure 23 on page 27](#)). Apply between 23 in.-lb. (2.6 Nm) and 25 in.-lb. (2.8 Nm) of torque to each nut. Do not overtighten the nut. (Use a 7/16-in. [11 mm] torque-controlled driver or socket wrench.)
 - a. Secure the positive (+) DC source power cable lug to the **RTN** (return) terminal.
 - b. Secure the negative (–) DC source power cable lug to the **–48V** (input) terminal.



CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when improperly threaded may result in damage to the terminal stud.



CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 in.-lb. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs.



CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines

the color coding for the leads on the power cables that attach to the terminal studs on each power supply.



NOTE: The DC power supplies in PEM0 and PEM1 must be powered by dedicated power feeds derived from feed A, and the DC power supplies in PEM2 and PEM3 must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.



NOTE: For information about connecting to DC power sources, see DC Power Supply Electrical Specifications for the MX480 Router.

12. Replace the clear plastic cover over the terminal studs on the faceplate.
13. Route the power cables along the cable restraint toward the left or right corner of the chassis. If needed to hold the power cables in place, thread plastic cable ties, which you must provide, through the openings on the cable restraint.
14. Verify that the power cabling is correct, that the cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.
15. Switch on the dedicated customer site circuit breakers. Follow your site's procedures for safety and ESD.

Verify that the **INPUT OK** LED on the power supply is lit green.
16. On each of the DC power supplies, turn the power switch to the on (—) position.

Observe the status LEDs on the power supply faceplate. If the power supply is correctly installed and functioning normally, the **PWR OK**, **BRKR ON**, and **INPUT OK** LEDs light green steadily.
17. Refer to [Table 5 on page 32](#) for the next slot to upgrade. If this is the last slot, the upgrade procedure is complete.



NOTE: An SCB must be present for the PWR OK LED to go on.

Figure 22: Installing a DC Power Supply in the Router

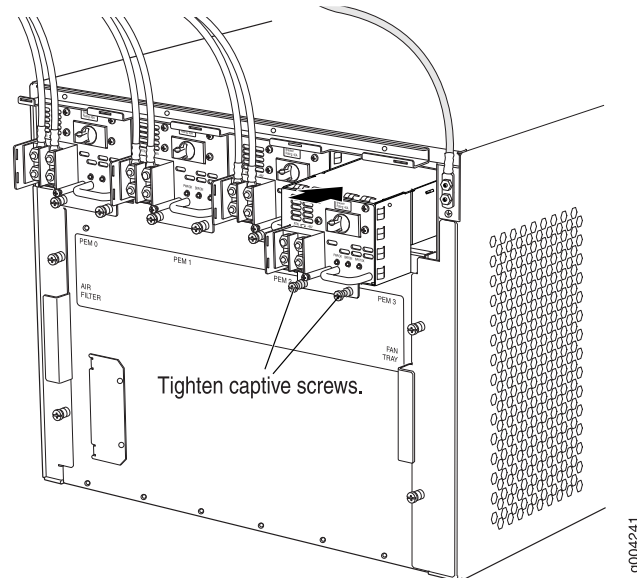
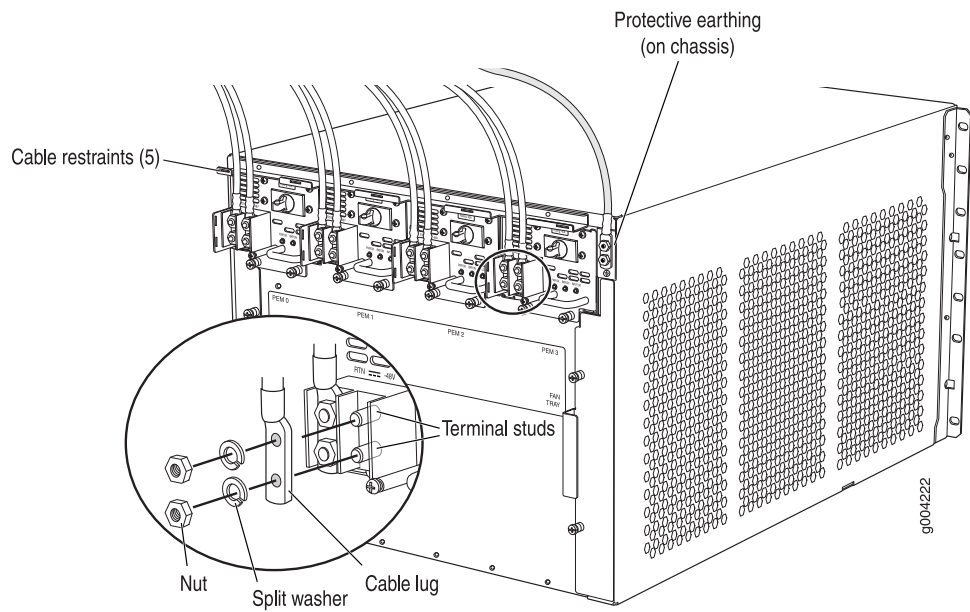


Figure 23: Connecting DC Power to the Router



Upgrading the MX960 AC Power Supplies

To upgrade the MX960 power supplies, use the procedures in the following sections.



NOTE: Before beginning this procedure, make sure that additional power distribution cables are in place. A second set of power cables are optional, depending on the configuration.



NOTE: The minimum number of power supplies must be present in the router at all times.



CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

Removing the MX960 Normal-Capacity AC Power Supplies

To remove a normal-capacity power supply, use the following procedures (see [Figure 24 on page 29](#)). Before you remove a power supply, be aware of the following:



NOTE: The minimum number of power supplies must be present in the router at all times.



CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.



NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove a normal-capacity AC power supply (see [Figure 24 on page 29](#)):

1. Move the AC input switch in the chassis above the power supply in slot 0 to the off (O) position.
2. Remove the power cord from the AC power source. Follow the ESD and disconnection instructions for your site.
3. Remove the power cord from the power supply.
4. While grasping the handle on the power supply faceplate with one hand, use your other hand to pull the spring-loaded locking pin in the release lever away from the chassis and turn the release lever counterclockwise until it stops.

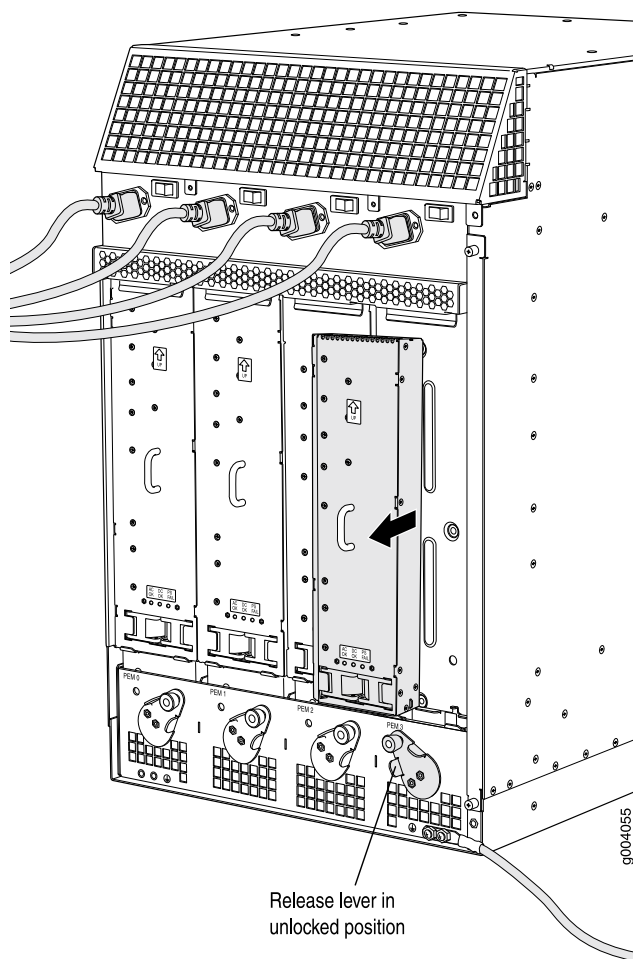
5. Let go of the locking pin in the release lever. Ensure that the pin is seated inside the corresponding hole in the chassis.
6. Pull the power supply straight out of the chassis as shown in [Figure 24 on page 29](#).



WARNING: Do not touch the power connector on the top of the power supply. It can contain dangerous voltages.

7. Repeat steps 1-6 for power supplies in slot 1, 2, 3 where present.

Figure 24: Removing an MX960 AC Power Supply



Installing the MX960 AC High-Capacity Power Supplies



NOTE: During the upgrade process, you can simultaneously run normal-capacity and high-capacity power supplies. However, it is recommended to upgrade all power supplies to high-capacity power supplies.

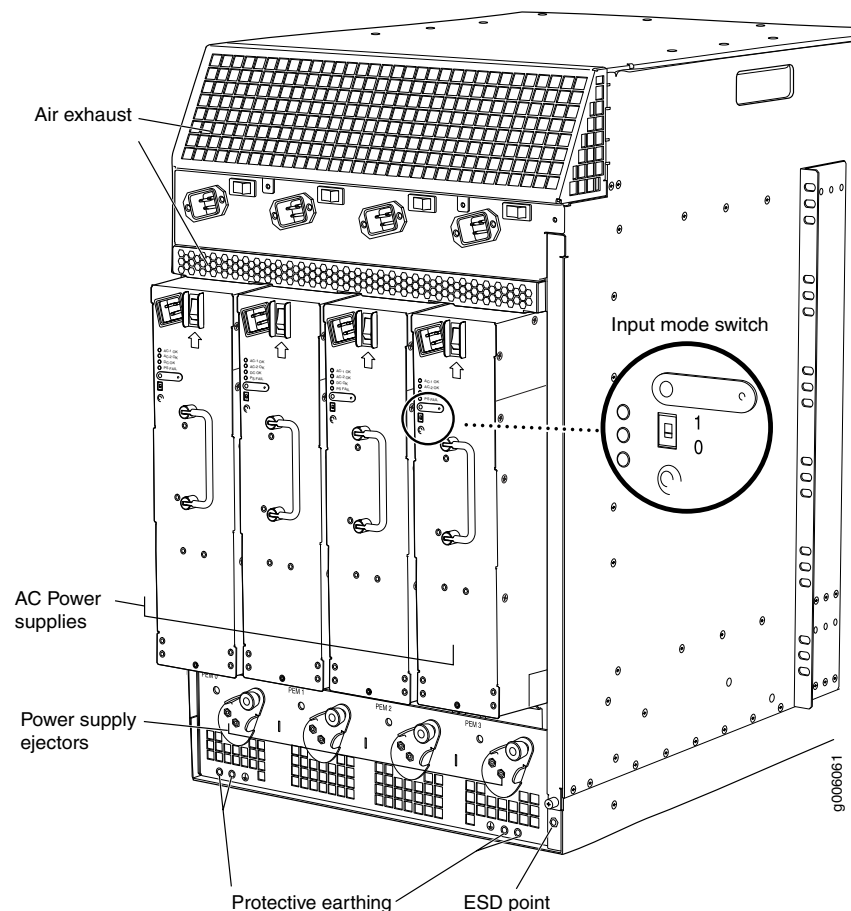


NOTE: A minimum of two AC nominal 220 VAC 20 amp power cords are required for this procedure.

To install an MX960 high-capacity AC power supply, use the following procedure (see [Figure 25 on page 30](#)).

1. Verify that the power switch on the power supply is in the off (O) position.
2. Ensure that the release lever below the empty power supply slot is locked in the counterclockwise position (see [Figure 25 on page 30](#)).

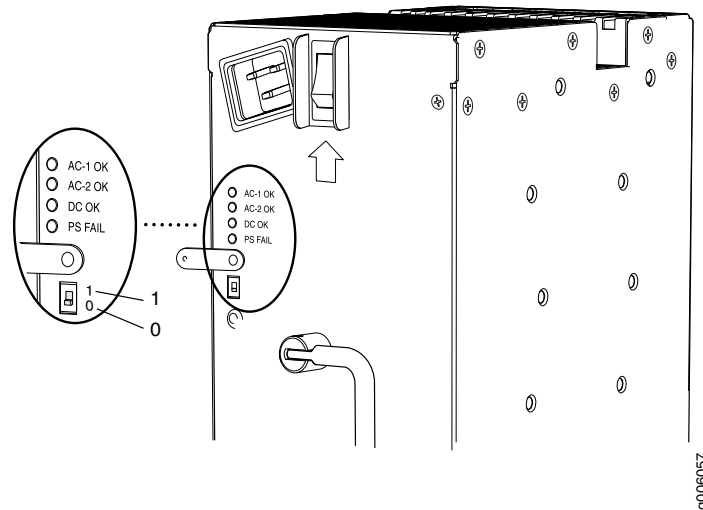
Figure 25: MX960 with High-Capacity AC Power Supplies Installed



If necessary, pull the spring-loaded locking pin in the release lever away from the chassis and turn the release lever counterclockwise until it stops. Let go of the locking pin in the release lever. Ensure that the pin is seated inside the corresponding hole in the chassis.

3. On the power supply, rotate the metal cover away from the input mode switch to expose the switch.
4. Move the input mode switch to position 0 for one feed or position 1 for two feeds (see [Figure 26 on page 31](#)).

Figure 26: MX960 AC Power Input Mode Switch



CAUTION: Do not use a pencil, because fragments can break off and cause damage to the power supply.

5. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot. The power supply faceplate will protrude beyond the chassis.
- The small tab on the metal housing that is controlled by the release lever must be inside of the corresponding slot at the bottom of the power supply (see [Figure 26 on page 31](#)). This tab is used to pull the power supply down in the chassis slot, prior to removing the power supply.
6. While firmly pushing the handle on the power supply faceplate with one hand, use your other hand to pull the spring-loaded locking pin in the release lever away from the chassis and turn the release lever clockwise until it stops.
 7. Let go of the locking pin in the release lever. Ensure that the pin is seated inside the corresponding hole in the chassis.
 8. Locate a power cord with the type of plug appropriate for your geographical location (see AC Power Cord Specifications for the MX960 Router).

9. Plug the power cord into the corresponding appliance inlet located in the chassis directly above the power supply. This is the recommend receptacle when using the power supply in one-feed mode. If using the power supply in two-feed mode, plug the second power cord into the receptacle on the power supply.



NOTE: Each power supply must be connected to a dedicated AC power feed and a dedicated customer site circuit breaker.

10. Dress the power cords appropriately. Verify that the power cord does not block the air exhaust and access to router components, and that they do not drape where people could trip on them.
11. Move the AC input switch above the power supply to the on (—) position. This is the only switch you have to turn on if you are using the power supply in one feed mode. If using the power supply in two-feed mode, move the power switch on the power supply to the on position. Remember to turn on both switches when operating the power supply in two-feed mode.
12. If the power supply is correctly installed and functioning normally, the **AC1 OK**, **AC2 OK** (two-feed mode only) **DC OK** LEDs light steadily, and the **PS FAIL** LED is not lit. See [Table 6 on page 32](#).
13. Refer to [Table 5 on page 32](#) for the next slot to upgrade. If this is the last slot, the upgrade procedure is complete.

Table 5: Normal-Capacity to High-Capacity Upgrade Sequence for MX240, MX480, and MX960

Upgrade power supply in slot 0 if present. If empty, skip to next slot.
Upgrade power supply in slot 1 if present. If empty, skip to next slot.
Upgrade power supply in slot 2 if present. If empty, skip to next slot.
Upgrade power supply in slot 3 if present.
Upgrade complete.

Table 6: MX960 High-Capacity AC Power Supply LEDs

Connected Inputs	DIP Switch Position	LEDs			
		AC-1 OK	AC-2 OK	DC OK	PS FAIL
PDM connected, power supply disconnected	0 (1 input)	Green	Off	Green	Off
PDM disconnected, power supply connected	0 (1 input)	Off	Green	Green	Off

Table 6: MX960 High-Capacity AC Power Supply LEDs (*continued*)

Connected Inputs	DIP Switch Position	LEDs			
		AC-1 OK	AC-2 OK	DC OK	PS FAIL
PDM connected, PS connected	0 (1 input)	Green	Green	Green	Off
PDM connected, PS disconnected	1 (2 inputs)	Green	Off	Off	Red
PDM disconnected, PS connected	1 (2 inputs)	Off	Green	Off	Red
PDM connected, PS connected	1 (2 inputs)	Green	Green	Green	Off

Note: The corresponding appliance inlet located in the chassis directly above the power supply is the recommend receptacle when using the power supply in one feed mode. If using the power supply in two-feed mode, plug the second power cord into the receptacle on the power supply

Note: PDM in the above table stands for Power Distribution Module.

Upgrading the MX960 DC Power Supplies Overview



NOTE: Before beginning this procedure, make sure that additional power distribution cables are in place. A 60 amp fuse is also required. A second set of power distribution feeds is optional.

To upgrade the MX960 DC power supplies, use the procedures in the following sections.

Removing a Normal-Capacity MX960 DC Power Supply



NOTE: The minimum number of power supplies must be present in the router at all times.



WARNING: Before performing DC power procedures, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.



CAUTION: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.



NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove a normal-capacity DC power supply (see [Figure 27 on page 35](#)):

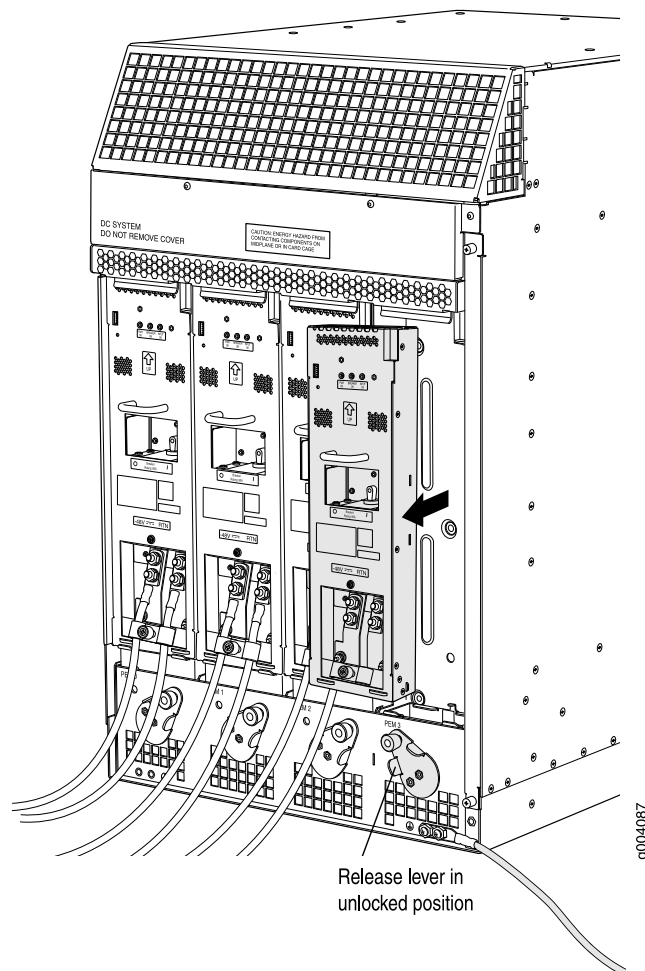
1. Switch off the dedicated customer site circuit breaker for the power supply being removed.
2. Verify that the **INPUT OK** LEDs on the power supply to be removed are not lit. Also verify that the **BREAKER ON** LED is not lit.
3. Move the DC circuit breaker on the power supply faceplate to the off (O) position.
4. Verify that the **INPUT OK** LEDs on the power supply to be removed are not lit. Also verify that the **BREAKER ON** LED is not lit.
5. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
6. Remove the clear plastic cover protecting the terminal studs on the faceplate from the power supply in slot 0.
7. Remove the nut and washer from each of the terminal studs. (Use a 7/16-in. [11-mm] nut driver or socket wrench.)
8. Loosen the captive screw on the cable restraint on the lower edge of the power supply faceplate.
9. Remove the cable lugs from the terminal studs.
10. Carefully move the power cables out of the way.
11. While grasping the handle on the power supply faceplate with one hand, use your other hand to pull the spring-loaded locking pin in the release lever away from the chassis and turn the release lever counterclockwise until it stops.
12. Let go of the locking pin in the release lever. Ensure that the pin is seated inside the corresponding hole in the chassis.
13. Pull the power supply straight out of the chassis (see [Figure 27 on page 35](#)).



WARNING: Do not touch the power connector on the top of the power supply. It can contain dangerous voltages.

14. Repeat steps 1-12 for power supplies in slot 1, 2, and 3, where present.

Figure 27: Removing a DC Power Supply from the MX960 Router



Installing the MX960 DC High-Capacity Power Supplies

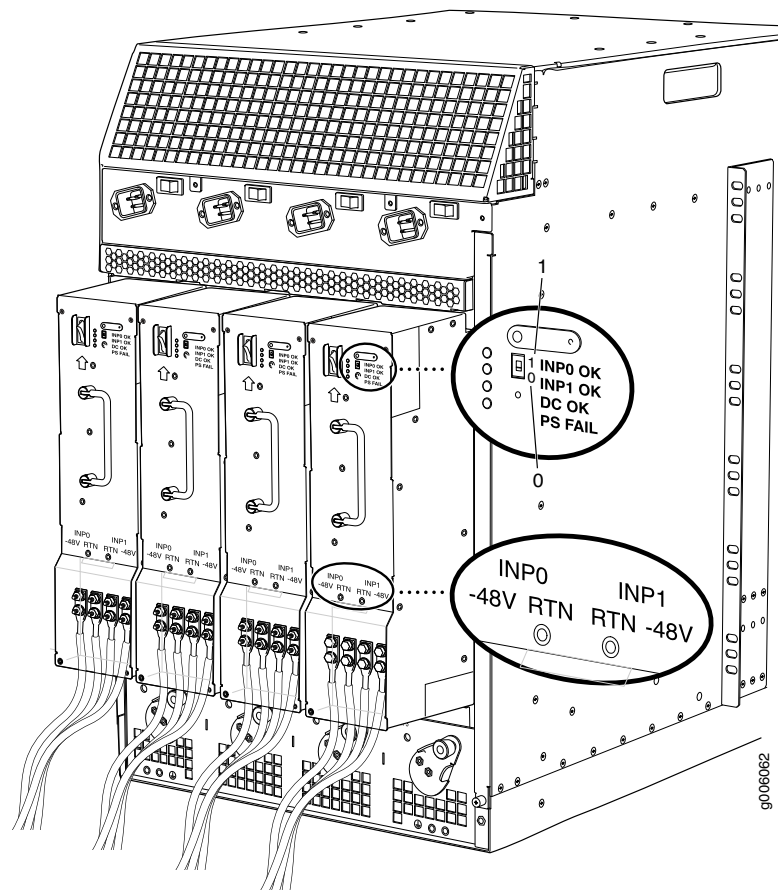
To install an MX960 DC high-capacity DC power supply:

1. Verify that the power switch on the power supply is in the off (O) position.
2. On the power supply, rotate the metal cover away from the input mode switch to expose the switch.
3. Move the input mode switch to position 0 for one feed or position 1 for two feeds (see [Figure 28 on page 36](#)).



NOTE: For a fully redundant configuration in two-feed mode, eight feeds are required. For a nonredundant configuration, four feeds are required.

Figure 28: MX960 with High-Capacity DC Power Supplies Installed



CAUTION: Do not use a pencil, because fragments can break off and cause damage to the power supply.

4. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.
5. Ensure that the release lever below the empty power supply slot is locked in the counterclockwise position.

If necessary, pull the spring-loaded locking pin in the release lever away from the chassis and turn the release lever counterclockwise until it stops. Let go of the locking pin in the release lever. Ensure that the pin is seated inside the corresponding hole in the chassis.

6. Using both hands, slide the power supply straight into the chassis until the power supply is fully seated in the chassis slot.

The small tab on the metal housing that is controlled by the release lever must be inside of the corresponding slot at the bottom of the power supply. This tab is used to pull the power supply down in the chassis slot, prior to removing the power supply.

7. While firmly pushing the handle on the power supply faceplate with one hand, use your other hand to pull the spring-loaded locking pin in the release lever away from the chassis and turn the release lever clockwise until it stops.
8. Let go of the locking pin in the release lever. Ensure that the pin is seated inside the corresponding hole in the chassis.
9. Remove the cover protecting the terminal studs on the faceplate.
10. Remove the nut and washer from each of the terminal studs.
11. Secure each power cable lug to the terminal studs, first with the split washer, then with the nut. Apply between 23 in-lb. (2.6 Nm) and 25 in-lb. (2.8 Nm) of torque to each nut. Do not overtighten the nut. (Use a 7/16-in. [11-mm] torque-controlled driver or socket wrench.)
 - a. On **INPUT 0**, attach the positive (+) DC source power cable lug to the **RTN** (return) terminal as shown in [Figure 28 on page 36](#). Repeat this step for **INPUT 1** if using two feeds.
 - b. On **INPUT 0** attach the negative (–) DC source power cable lug to the **–48V** (input) terminal. Repeat this step for **INPUT 1** if using two feeds.



CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when improperly threaded may result in damage to the terminal stud.



CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 in-lb. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs.



NOTE: The DC power supplies in slots PEM0 and PEM1 must be powered by dedicated power feeds derived from feed A, and the DC power supplies in PEM2 and PEM3 must be powered by dedicated power feeds derived from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system. For information about connecting to DC power sources, see Electrical Specifications for the MX960 DC Power Supply.

12. Verify that the power cabling is correct, that the cables are not touching, and that they do not block access to router components or drape where people could trip on them.

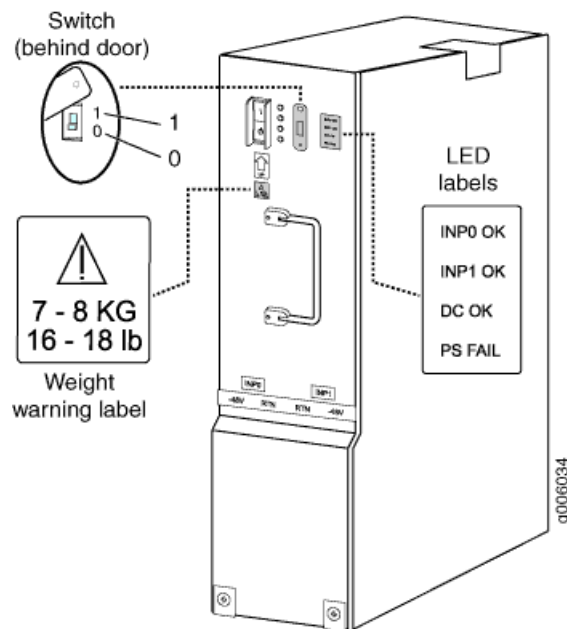
13. Replace the clear plastic cover over the terminal studs on the faceplate.
14. Switch on the dedicated customer site circuit breaker.
15. Verify that the **INPUT 0 OK** or **INPUT 1 OK** LEDs on the power supply are lit green steadily. If using two feeds, verify that both **INPUT 0 OK** and **INPUT 1 OK** LEDs on the power supply are lit steadily. The **INPUT OK** will be lit amber if that input's voltage is in reverse polarity. Check the polarity of the power cables to fix the condition (see [Figure 29 on page 39](#) and [Table 7 on page 38](#)).
16. Move the switch to the on (I) position.
17. Verify that the **DC OK** LED is lit green steadily. See [Table 7 on page 38](#) for information on MX960 high-capacity DC LEDs.

Table 7: MX960 High-Capacity DC Power Supply LEDs

Connected Inputs	DIP Switch Position	LEDs			
		INP-0 OK	INP-1 OK	DC OK	PS FAIL
INP0 connected, INP1 disconnected	0 (1 input)	Green	Off	Green	Off
INP0 disconnected, INP1 connected		Off	Green	Green	Off
INP0 connected, INP1 connected		Green	Green	Green	Off
INP0 connected, INP1 disconnected	1 (2 inputs)	Green	Off	Off	Red
INP0 disconnected, INP1 connected		Off	Green	Off	Red
INP0 connected, INP1 connected		Green	Green	Green	Off

18. Repeat steps 1-17 for installing power supplies in slots 1, 2, 3 where present.

Figure 29: MX960 DC High-Capacity Power Supply Front View



19. Install a blank panel over the power distribution modules, if available.



NOTE: The MX960 DC power supplies protrude approximately 5 inches from the back of the chassis.

Upgrading from Single-feed to Dual-feed Configuration on a MX960 AC High-Capacity Power Supply

The MX960 high-capacity AC Power supplies can operate in one-feed and two-feed modes. This is controlled by a mode switch on the power supply. Two-feed mode provides the full power of the power supply and requires 8 feeds for the entire system. One-feed mode provides reduced power and requires 4 feeds for the entire system.



NOTE: Before starting the upgrade procedure, ensure that the desired number of additional feeds are available.



NOTE: The primary and redundant PEMs need to be have the same number of feeds. PEM 0 should have the same number of feeds as PEM 2. PEM 1 should have the same number of feeds as PEM 3.



NOTE: The power supplies in PEM 0 and PEM 1 must be powered by dedicated power feeds derived from feed A, and the power supplies in PEM 2 and PEM 3 must be powered by dedicated power feeds from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.



NOTE: When upgrading the feeds for multiple power supplies, follow the upgrade sequence in [Table 5 on page 32](#) for the order of the slots to upgrade.

To upgrade from a single-feed to dual feeds:

1. Locate a power cord with the type of plug for your geographical location (see AC Power Cord Specifications for the MX960 Router).
2. Plug the power cord into the receptacle on the power supply.
3. Insert the power cord plug into an external AC power source receptacle.
4. Dress the power cords appropriately. Verify that the power cord does not block the air exhaust. Drape the power cord where people cannot trip on it.
5. On the power supply, rotate the metal cover away from the input mode switch to expose the switch.
6. Move the input mode switch to position 1 for two feeds (see [Figure 26 on page 31](#)).
7. Move the AC input switch in the chassis to the ON position.
8. If the power supply is correctly installed and functioning normally, the **AC-1 OK**, **AC-2 OK**, and **DC OK** LEDs light steadily and the **PS FAIL** LED is not lit. See [Table 6 on page 32](#) for information on MX960 high-capacity AC LEDs.

Upgrading from Single-Feed to Dual-Feed Configuration on an MX960 DC High-Capacity Power Supply

The MX960 high-capacity DC Power supplies can operate in one-feed and two-feed modes. This is controlled by a mode switch on the power supply. Two-feed mode provides the full power of the power supply and requires 8 feeds for the entire system. One-feed mode provides reduced power and requires four feeds for the entire system.



CAUTION: Do not upgrade the feeds on the high-capacity DC power supply while it is in operation. Make sure the covers on the adjacent power supplies are in place and there is no chance of accidentally touching a live feed.



CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity. There is no standard color coding for DC power cables. The

color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on each power supply.



NOTE: Before starting the upgrade procedure, ensure that the desired number of additional feeds are available.



NOTE: The primary and redundant PEMs need to have the same number of feeds. PEM 0 should have the same number of feeds as PEM 2. PEM 1 should have the same number of feeds as PEM 3.



NOTE: The power supplies in PEM 0 and PEM 1 must be powered by dedicated power feeds derived from feed A, and the power supplies in PEM 2 and PEM 3 must be powered by dedicated power feeds from feed B. This configuration provides the commonly deployed A/B feed redundancy for the system.



NOTE: When upgrading the feeds for multiple power supplies, follow the upgrade sequence in [Table 5 on page 32](#) for the order of the slots to upgrade.

To upgrade from a single-feed configuration to a dual-feed configuration on an MX960 DC high-capacity power supply:

1. Switch off the dedicated customer site circuit breaker for the power supply being upgraded. Follow your site's procedures for electrostatic discharge (ESD).
2. Verify that the power switch on the power supply is also in the off (O) position.
3. On the power supply, rotate the metal cover away from the input mode switch to expose the switch.
4. Move the input mode switch to position 1 for two feeds (see [Figure 26 on page 31](#)).
5. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance the cable leads might become active during installation.
6. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.
7. Remove the cover protecting the terminal studs on the faceplate.
8. Remove the nut and washer from each of the terminal studs.
 - a. On **INPUT 1**, attach the positive (+) DC source power cable lug to the **RTN** (return) terminal as shown in [Figure 28 on page 36](#).

- b. On **INPUT 1** attach the negative (–) DC source power cable lug to the **–48V** (input) terminal.
9. Secure each power cable lug, first with the split washer, then with the nut. Apply between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm) of torque to each nut. Do not overtighten the nut. (Use a 7/16-in. [11-mm] torque-controlled driver or socket wrench.)



CAUTION: Ensure that each power cable lug seats flush against the surface of the terminal block as you are tightening the nuts. Ensure that each nut is properly threaded onto the terminal stud. The nut should be able to spin freely with your fingers when it is first placed onto the terminal stud. Applying installation torque to the nut when improperly threaded may result in damage to the terminal stud.



CAUTION: The maximum torque rating of the terminal studs on the DC power supply is 36 lb-in. (4.0 Nm). The terminal studs may be damaged if excessive torque is applied. Use only a torque-controlled driver or socket wrench to tighten nuts on the DC power supply terminal studs.



CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on each power supply.

10. Verify that the power cabling is correct, that the cables are not touching, and that they do not block access to router components or drape where people could trip on them.
11. Replace the clear plastic cover over the terminal studs on the faceplate.
12. Switch on the dedicated customer site circuit breaker.
13. Verify that the **INPUT 0 OK** or **INPUT 1 OK** LEDs on the power supply are lit steadily. If using two feeds, verify that both **INPUT OK** LEDs on the power supply are lit steadily.
14. Move the switch to the on (I) position.
15. Verify that the **DC OK** LED is lit green.

Changing the MX240 and MX480 DC High-Capacity Power Supply Input Mode Switch

The input mode switch determines the capability of the feed, which in turn is used by the power management software. Move the input switch to position 0 for 60-A input and position 1 for 70-A input.

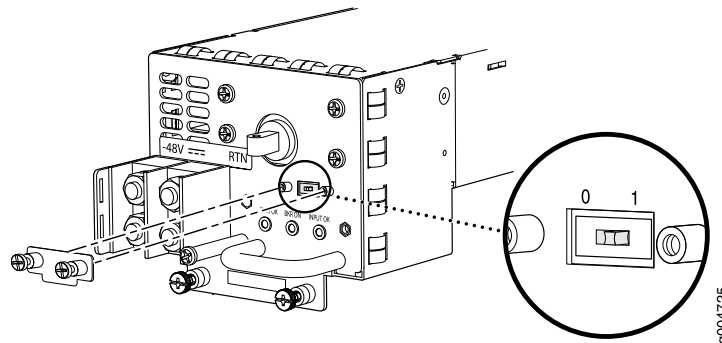


NOTE: Do not set the input mode switch if the power supply is installed in the chassis. If the power supply is already installed, you must remove it before setting the input mode switch.

To set the input mode switch:

1. Using a screwdriver, loosen the captive screw holding the metal cover over the input mode switch.
2. Rotate the metal cover away from the input mode switch to expose the switch.
3. Check the setting of the input mode switch (see [Figure 30 on page 43](#)).
4. Use a sharp, nonconductive object to slide the switch to the desired position.

Figure 30: MX240 DC and MX480 DC High-Capacity Power Supply Input Mode Switch



CAUTION: Do not use a pencil, because fragments can break off and cause damage to the power supply.

5. Rotate the metal cover over the input mode switch, and use a screwdriver to tighten the captive screw.

JUNOS Documentation and Release Notes

For a list of related JUNOS documentation, see <http://www.juniper.net/techpubs/software/junos/>.

If the information in the latest release notes differs from the information in the documentation, follow the *JUNOS Release Notes*.

To obtain the most current version of all Juniper Networks[®] technical documentation, see the product documentation page on the Juniper Networks website at <http://www.juniper.net/techpubs/>.

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need postsales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the JTAC User Guide located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC Hours of Operation —The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: <http://www.juniper.net/customers/support/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://www.juniper.net/alerts/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://tools.juniper.net/SerialNumberEntitlementSearch/>

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at <http://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, visit us at <http://www.juniper.net/support/requesting-support.html>

Revision History

July 2012— Made changes to the High Capacity DC Power Supply graphic to include a call out showing the dip-switch position settings “0” and “1”

April 2011 —Made minor document modifications.

February 2011— Added various procedural document enhancements, added additional illustrations and tables.

December 2010— Added note regarding required feeds for MX960 DC high-capacity power supplies.

August 2010— Added MX960 DC high-capacity power supply content.

April 2010— Initial release.

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